International Journal of Surgery 9 (2011) 83–85

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.theijs.com

Risk factors predictive of severe diverticular hemorrhage

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ARTICLE INFO

Article history:
Received 14 September 2010
Accepted 18 September 2010
Available online 14 October 2010

Keywords:
Diverticulosis
Hemorrhage
Lower gastrointestinal bleed

ABSTRACT

Background: Diverticular disease is a common cause for lower gastrointestinal bleeding. Although the hemorrhage often resolves spontaneously, some patients will require massive transfusions and emergency surgery. In this study we report risk factors predictive of severe diverticular bleeds.
Methods: We completed a retrospective analysis of 99 patients, admitted with lower gastrointestinal bleeding and colonoscopic evidence of diverticulosis and no other cause of the hemorrhage between January 1995 and December 2005. A database was generated and univariate and multivariate analyses were carried out.
Results: Of the 99 patients, 23 patients were classified as having a severe bleed defined as having a systolic blood pressure below 90 mm Hg, requirement for more than 6 units of transfusion, or emergent surgery. Multiple logistic regression showed that the initial hemoglobin ($p = 0.001$), INR ≥ 1.5 ($p = 0.003$), initial diastolic blood pressure ($p = 0.024$), initial heart rate ($p = 0.047$), and blood pressure medications ($p = 0.049$) predicted severe diverticular hemorrhage.
Conclusions: The identified predictor variables are all quantifiable at the time of initial presentation, and these may help identify severe cases of diverticular bleeding requiring urgent management.

1. Introduction

Diverticular disease has become one of the most common diseases afflicting the industrialized nations. Although low fiber diet and advancing age is associated with this, the exact etiology is unknown.[1,2] Fortunately, most individuals with diverticulosis remain asymptomatic. In North America, the most common cause of lower gastrointestinal bleeding (LGIB) is bleeding colonic diverticuli.[3] Most of these LGIB will resolve spontaneously, but as many as 48% will require blood transfusions and 18–53% will require emergency surgery.[4]

Although the spectrum of diverticular hemorrhage ranges from spontaneous resolution to requiring massive transfusions and emergency surgery, data to allow us to identify those at high risk of ongoing bleeding have not yet been elucidated. The purpose of this retrospective study is to identify patient characteristics that predict increased risk for massive transfusion, emergency surgery and hemodynamic instability. With the identification of high risk patients, clinicians can be alerted for a poorer prognosis and the patients can be triaged and managed accordingly.

2. Methods

We conducted a retrospective analysis of patients admitted to Royal University Hospital, Saskatoon, Saskatchewan between January 1, 1995 and December 31, 2005, with the primary diagnosis of diverticulosis and no other cause of hemorrhage on colonoscopy. The study was approved by the institutional review boards at the University of Saskatchewan. Because active bleeding from diverticula is seldom seen, stringent inclusion and exclusion criteria were applied. We started with patients admitted with clinical evidence of an LGIB who also had diverticulosis and no other cause for hemorrhage on colonoscopy. Patients with a history of colonic neoplasms, angiodysplasia, colon surgery within the last three months, or vascular grafts were excluded. Patients who were older than 90 years were also excluded.

Our search criteria at the Health Records Department turned up 132 entries. Of these, three were excluded because of colonic neoplasms, seven for angiodysplasia and five were excluded because there were other apparent causes for the presumed LGIB (three for upper gastrointestinal causes and two for rectal causes). Another five were excluded because no diverticulosis was documented on colonoscopy for these patients. From this group, 99 patients were equal or younger than 90 years old. A total of 99 patients met these criteria and formed the study population.

A diverticular bleed was said to be severe ($n = 23$) if the patient required more than six units of packed red blood cells, the patient was taken for emergency surgery or a systolic blood pressure below 90 mm Hg was recorded within the first 24 h of admission. Patients without any of the characteristics above made up the non-severe diverticular bleed group ($n = 76$). Admission bloodwork was the first set of

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doi:10.1016/j.ijsu.2010.09.011

bloodwork documented on the cumulative lab report. Admission vitals were the first set of vitals recorded by the emergency nurse.

Descriptive, univariate and multivariate analyses were performed using STATA software (StataCorp, College Station, Tx, USA). Chi-square tests were used to compare proportions and Student's *t*-test to compare mean values. A *p*-value of less than 0.05 was considered to indicate statistical significance. For logistic regression analyses, patients with severe bleed formed the outcome or dependent variable. Sex, age, smoking, and comorbidities such as diabetes, heart disease, were independent variables. Univariate analysis was carried out to evaluate each variable for its unadjusted association with outcome. Independent variables with a *p*-value < 0.20 in the univariate analysis were selected for the multivariate logistic regression.

3. Results

Of the 99 patients, 23 patients were classified as having a severe bleed and the remaining 76 patients had non-severe bleeds. Of the 23 patients who had a severe diverticular bleed, seven had a hypotensive episode, nine had massive transfusions, three had emergency surgeries, two combination of transfusion and surgery and two with combination of hypotension and transfusion. Of the seven patients who had emergency surgery for their diverticular bleed, four (57%) had a massive transfusion of more than six units and two (29%) patients had a hypotensive episode. Whereas of the fourteen patients who had a massive transfusion, only 4 (29%) went to the operating room. And of the nine patients who had one or more hypotensive episode, two (22%) went to the operating room. The demographics were similar between the two groups of patients (Table 1).

Univariate analysis yielded five characteristics which had a $p < 0.20$ when the two groups were compared (Table 2). They included patients taking any blood pressure medications and on admission: increased heart rate (76 ± 14 versus 82 ± 23, $p < 0.058$), decreased diastolic blood pressure (78 ± 14 versus 67 ± 23, $p < 0.0051$), low initial hemoglobin (115 ± 21 versus 89 ± 25, $p < 0.001$) and INR ≥ 1.5.

A multivariate logistic regression was constructed using the five variables and included age, a standard covariate. The resulting model is shown in Table 3.

4. Discussion

Our results suggest that a severe diverticular hemorrhage can be predicted by factors measured at the time of presentation to the Emergency Department: blood pressure medications, tachycardia, low diastolic blood pressure, low hemoglobin and INR ≥ 1.5. Intuitively, the identified risk factors make sense. For the most part, diverticular hemorrhage is brisk and presentation to emergency is seldom delayed. Thus, initial measures of hemoglobin, heart rate and diastolic blood pressure represent values obtained very shortly after the onset of bleeding and these suggest a larger initial blood loss.

As diverticular hemorrhage originates from arteriolar bleeding, the use of antihypertensive agents may (or even the presence of arteriosclerosis) interfere with arteriolar vasoconstriction. Decreased hemoglobin indicates that an initial transfusion may be needed but not necessarily that a massive transfusion is needed. Coagulopathy, by itself, does not mandate a transfusion, but our study shows that an increased INR predicts a more severe diverticular bleed. This is, again, in keeping with the magnitude of the bleed at onset being important in the patient's prognosis.

Although patient records from the last ten years were reviewed, our sample size was only 99. The small sample size is most likely related to our stringent inclusion criteria that the patient must have diverticulosis documented on colonoscopy without any other cause of lower gastrointestinal bleed. Clinically, not all patients that were admitted with a presumptive diagnosis of diverticular bleed were offered a colonoscopy. With this small sample size, statistical power may not have been adequate to detect smaller differences between the groups in other patient characteristics. This study was also limited to the major academic center in the city of Saskatoon, Saskatchewan, Canada which also has two other hospitals. Geographical and hence demographical differences may ensue between the three sites hence skewing the data in this study.

There were no studies in OVID MedLine (1966–August 2010) documenting risk factors predictive of severe diverticular bleeds. Furthermore, there were no studies looking at patient characteristics that would help to stratify patients with diverticular bleeds into a high or low risk group. However, Strate et al[5] was able to develop and prospectively validate a clinical prediction rule for acute severe LGIB. They identified that heart rate $\geq$100/min, systolic blood pressure $\leq$115 mm Hg, syncope, nontender abdominal exam, rectal bleeding in the first 4 h of evaluation, aspirin use, and more than two comorbid conditions were predictors of severe bleeding. Considering that diverticular hemorrhage causes the majority of LGIB, these risk factors were similar to those found in our study – low hemoglobin, INR ≥ 1.5, low diastolic blood pressure, tachycardia and being on blood pressure medications. Intuitively, patients on anticoagulation suffer more severe consequences of diverticular bleed and this was confirmed both in our study and also Hashash et al.[6]

Recent studies have shown that there is a relationship between the usage of aspirin and other non-steroidal anti-inflammatory drugs (NSAIDs) and LGIB[7] and specifically diverticular bleeds.[8] In

Table 1
Demographics of study patient population. Selected characteristics of control and severe group shown – none were significantly different between the control and severe bleed group. NSAID = non-steroidal anti-inflammatory drugs.

Characteristic	Control group ($n = 76$)	Severe bleed ($n = 23$)	*p*-value
Gender (Female)	33	10	>0.05
Age (±SEM)	76 ± 10	74 ± 12	>0.05
Smoking (%)	5 (7)	2 (9)	>0.05
Previous admission for diverticular bleeding (%)	19 (25)	3 (13)	>0.05
Any NSAID (%)	34 (45)	12 (52)	>0.05

Table 2
Univariate analyses of factors involved in severe diverticular bleeds. Included are only patient characteristics that had a $p < 0.20$. BP = blood pressure, HR = heart rate, DBP = diastolic blood pressure, Hgb = hemoglobin, INR = International Normalized Ratio.

Characteristic	Benign bleed $n = 76$ (%)	Severe bleed $n = 23$ (%)	OR	95% CI	*p*-value
BP meds	40 (52)	16 (70)	2.06	0.76–5.57	0.16
HR	76 ± 14	82 ± 23	1.03	1.00–1.07	0.058
DBP	78 ± 14	67 ± 23	0.95	0.92–0.99	0.0051
Hgb	115 ± 21	89 ± 25	0.95	0.92–0.97	<0.001
INR ≥ 1.5	5 (7)	9 (39)	9.13	2.66–31.37	<0.001

Table 3
Multivariate analyses of factors involved in severe diverticular bleeds. Hgb = hemoglobin, INR = International Normalized Ratio, DBP = diastolic blood pressure, HR = heart rate, BP = blood pressure.

Characteristic	OR	95% CI	*p*-value
Hgb	0.94	0.91–0.98	0.001
INR ≥ 1.5	15.5	2.52–95.7	0.003
DBP	0.96	0.92–0.99	0.024
HR	1.05	1.00–1.10	0.047
BP meds	4.41	1.00–19.37	0.049

this study, the usage of non-steroidal anti-inflammatory drugs (NSAIDs) and aspirin (both high dose and low dose) was found not to be predictive of severe diverticular bleed. Perhaps the sample size of our study was inadequate to detect the significance. Because of the limitation of our small sample size, factors identified in other studies may not have reached statistical significance, for example NSAIDS. Nevertheless, five factors did reach statistical significance. Our small sample size is in part due to our stringent inclusion criteria which included an initial diagnosis of LGIB and colonoscopic evidence of diverticulosis with no other causes for the LGIB. The patients who did not receive a colonoscopy may represent those who have had previous colonoscopy documenting diverticular disease and had a minor bleed. Our study would not have included these patients and NSAIDs may be associated with less severe diverticular bleeds.[9]

Although Foutch's[8] study demonstrated that the presence of a visible vessel or an adherent clot with active bleeding to be a reliable marker for significant diverticular hemorrhage, we were unable to demonstrate any correlation between a severe bleed and colonoscopic appearance of the diverticuli. Also, age and previous diverticular bleeds were not predictive. This was unlike Rios et al[10] who found that age was significant.

The classic dictum of taking patients to the operating room if they received six or more units of packed red blood cells or if they became hypotensive was not used as an absolute indication for emergency surgery. Clinical judgment involving other unknown factors was involved. Although evidence indicates that early colonoscopy can help to identify that the source of bleeding is colonic diverticulosis patient mortality and morbidity were not affected in one study.[11]

During an episode of diverticular hemorrhage, the diagnosis is almost always presumed as a bleeding diverticula is seldom visualized directly with colonoscopy. Angiography and nuclear medicine scans can only show the general areas of bleeding. Although stringent inclusion and exclusion criteria were applied to this study, the diagnosis is still almost always presumptive. Because of the retrospective nature of this study, inherent bias of surgical decisions cannot be excluded. Further extension of this study can compare the clinical outcomes of patients who were offered surgery to those who were not.

In conclusion, it seems as though measures obtainable at the time of presentation are useful in predicting severity of diverticular hemorrhages. This study may form the basis to establish a scoring system on which to stratify patients admitted for diverticular bleeds. A clinical tool that triage patients into different severity groups would help to identify sicker patients earlier on and help to provide appropriate level of care and interventions and guide more standardized and cost-effective approach to this common disease.

Conflict of interest

None of the authors has any conflict of interest to declare.

Funding

This study was funded by the Department of Surgery Research Chair Funds, University of Saskatchewan.

Ethical approval

Ethical Approval was given by the University of Saskatchewan, Biomedical Research Ethics Board. Bio#05-215.

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